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Black Vine Weevils at the Coeur d'Alene Nursery

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Black vine weevils, *Otiorhynchus sulcatus*, were discovered at the Coeur d'Alene Forest Service Nursery in late fall 2014. Damage was first found on the root collars of grafted western larch growing in gallon containers and larvae were discovered in the soil around their roots. Later, larvae were found in the roots of two-year old container whitebark pine seedlings as they were lifted for storage. This report documents monitoring and control methods performed to minimize damage from the weevils and additional management methods that could be considered in future years.

Introduction

Black vine weevils are one of the primary root weevils that cause damage to seedlings in Pacific Northwest forest nurseries (Hamm et al. 1990). They are native to Europe but have spread to many countries around the world with plant shipments. Adult vine weevils are parthenogenic females; there are no males (Moorhouse et al. 1992). Black vine weevils overwinter as larvae in the soil, pupate in the spring, and emerge as adults from late May through June. Adults are about ½ inch long and feed on foliage for 3-4 weeks before laying eggs. They are nocturnal—hiding during the day and feeding at night. Damage to foliage occurs as notching of leaves or needles but seldom impacts plant health. Each adult can lay over 500 eggs. Eggs are laid on the soil near the base of host plants and hatch in 10-14 days. Larvae are the most destructive life stage, feeding on roots and lower stems. They can be found down to ten inches deep in the soil. There is one generation per year but different life stages may be present at the same time. Predators of root weevils include ground beetles, spiders, frogs, toads, rodents, birds, and nematodes (Moorehouse et al. 1992).

Black vine weevil adults do not fly but are good crawlers. Most weevils in a mark, release, and recapture study in Connecticut were recovered within 33 feet of their release site but some had dispersed over 77 yards (Maier 1978). They have a large host list of over 100 plant species. In the Pacific Northwest, most significant damage occurs on conifer seedlings, berry plants, and rhododendrons (Hamm et al. 1990). They are also reported to feed on clover and many woody shrubs (Masaki et al. 1984).

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Damage at the Nursery

Damage was discovered on three-year old grafted western larch trees planted in one gallon pots in the tree improvement greenhouses in November 2014. Damage occurred on the lower stem and root collar where bark was removed by insect chewing (figure 1). Larvae were found in the soil within the root zone (figure 2).

Figure 1. Black vine weevil damage on the lower stem and root crowns of western larch.

Figure 2. Weevil larvae found in the root zone of western larch in gallon containers.

In December 2014, larvae and root damage was discovered in two-year old whitebark pine containerized seedlings grown in a Quonset style greenhouse as they were being lifted for cold storage. Larvae were removed before the seedlings were stored. Weevil larvae were also found in two- and three-year old *Salix* spp., *Populus* spp., and *Alnus* spp. in the native plant production program.

Larvae and pupae collected in the spring 2015 from infested native plants were reared to adults in the lab (figure 3).

Figure 3. Black vine weevil pupa side view (top left) and ventral view (bottom left) and adult weevil (right).

Black vine weevil adults are attracted to moist areas in and around buildings. This could explain why they were attracted to the greenhouses at the nursery (Cranshaw 2014). Clover is listed as one of their hosts, and we found rabbit foot clover (*Trifolium arvense)* growing in the lawn near the greenhouses but could not determine if this was a source of the weevils.

Insecticide Treatments and Monitoring at the Nursery

The best results in controlling root weevils with insecticides have come from targeting adults in spring and early summer. However, since potentially infested western larch were going to be out-planted in the spring before adults emerged, insecticide treatments were applied to soil in the gallon containers in attempts to control larvae in November and December before the larch went into cold storage. The systemic insecticide, Safari® (dinotefuran) and the contact insecticide, Astro® (permethrin) were applied to the soil but did not cause larval mortality in monitored containers. On February 27 and March 19, 2015, Acephate97UP® was applied as a root drench to the soil around dormant larch grafts before they were shipped for out-planting near Plains, Montana in early April. It was reported that some weevil larvae were still active in the potted soil at the time of planting.

The first adult weevil at the Coeur d'Alene nursery was found on February 24, 2015 a shelter house style greenhouse that was warm and humid for seedling grafting. The adult was found on top of a one gallon

pot holding a whitebark pine rootstock plant. Additional adults were found from March-June. Adult weevils were monitored using 2x4" boards with a groove cut down the middle (groove side down) to provide a hiding place for adults during the day (figure 4). In addition, adults were found and monitored under plastic pallets in the tree improvement greenhouses. More adults were found under the plastic pallets than under the monitoring boards. Alternating treatments of Safari® and Acephate97UP® were applied shortly after adults were detected and every 3 weeks afterward until no more adults were seen. These treatments were successful in killing many of the adult weevils.

Figure 4. Board with groove cut in center for monitoring adult root weevils. The board is placed groove-side down to provide a hiding place for weevils during the day.

Other Weevil Management Options

Monitoring/Prevention

In addition to boards with grooves for monitoring adults, pieces of burlap or cardboard placed loosely around the base of host plants provide a place for adults to hide during the day (Hoover 2000). Black vine weevil larvae have been detected on plant roots without destructively pulling plants out of containers by using sensitive acoustic instrumentation (Mankin & Fisher 2007).

Since damage by adult weevils on conifer seedling needles can be difficult to detect, potted monitoring plants of susceptible species such as rhododendrons or strawberries can be placed in strategic locations to attract weevils (Cram et al. 2013; Sutherland and Van Eerden 1980; Tami Jebb, Oregon BLM Horticulturist, personal communication). Such monitoring plants can be examined for notched leaves in the spring and also searched for adult weevils at night. Monitoring plants, boards or other materials should not be placed where intensive watering occurs as weevils tend to avoid very wet areas (Smith 1932).

Placing the feet of tables holding container seedlings in containers of salty/soapy water or oil can prevent weevils from crawling up the table legs to access container seedlings. Sticky tape on the sides of greenhouses or in doorways where weevils might enter can also trap adults. Diatomaceous earth helps control many crawling insects and can be spread on the floor of or outside of greenhouses where weevils may be crawling to help prevent them from accessing seedlings (Bill Schaupp, R-6 FHP Entomologist, personal communication).

Movement of soil from infested areas to non-infested areas should be restricted or soil should be sterilized to prevent weevil spread (Smith 1932).

Biological Control

Entomophagous nematodes can control weevils in container-grown seedlings. They parasitize larvae, pupae and also newly-emerged weevil adults (Moorehouse et al. 1992). However, effectiveness depends on matching their specific environmental requirements. To be effective, nematodes cannot be exposed to direct sunlight. Soil should be thoroughly wet and at a temperature of at least 52^{o} F prior to application. If they are applied through a watering system, filtering mesh screens should be removed to prevent nematodes from getting caught and clogging nozzles (Cram et al. 2012).

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